

CLAIMS

1. Hydrocracking process for the production of middle distillates by conversion of a hydrocarbon feedstock that has a nitrogen content of more than 500 ppm by weight, characterized in that it comprises:

- a hydrorefining stage in which the feedstock is brought into contact with the hydrogen in the presence of a hydrorefining catalyst, at a temperature T1, and an effluent that comprises converted products and unconverted products is recovered,
 - optionally a separation stage in which at least a portion of the converted products formed during the hydrorefining stage and a fraction that comprises the unconverted products are separated, and
 - a hydrocracking stage, in which the unconverted products are, at least in part, brought into contact with the hydrogen, in the presence of an amorphous hydrocracking catalyst that comprises a substrate, palladium and platinum, at a temperature T2 that is less than T1, whereby the difference between T1 and T2 is between 5 and 50°C.
2. Process according to the claim, wherein the difference between T1 and T2 is between 15 and 30°C.
3. Process according to any of claims 1 and 2, wherein the hydrorefining catalyst also comprises at least one dopant that is deposited on said catalyst and selected from the group that is formed by phosphorus, boron and silicon.
4. Process according to any of claims 1 to 3, wherein the hydrorefining stage is carried out at a temperature T1 that ranges from 330 to 420°C.

5. Process according to any of claims 1 to 4, wherein the fraction that is subjected to a hydrocracking stage essentially consists of products that have a boiling point of more than 340°C.
6. Process according to any of claims 1 to 5, wherein the organic nitrogen content of the portion of the fraction that comprises unconverted products that is subjected to the hydrocracking stage is less than 10 ppm by weight, and the organic sulfur content of the portion of the fraction that comprises the unconverted products that is subjected to the hydrocracking stage is less than 100 ppm by weight.
7. Process according to any of claims 1 to 6, wherein the H₂S content of the portion of the fraction that comprises the unconverted products that is subjected to the hydrocracking stage is less than 100 ppm by weight, and the NH₃ content of the portion of the fraction that comprises the unconverted products that is subjected to the hydrocracking stage is less than 100 ppm by weight.
8. Process according to any of claims 1 to 7, wherein the substrate of the hydrocracking catalyst is an amorphous silica-alumina.
9. Process according to claim 8, wherein the substrate of the hydrocracking catalyst comprises:
 - an amount that is more than 10% by weight and less than or equal to 80% by weight of silica (SiO₂),
 - a mean pore diameter, measured by mercury porosimetry, encompassed between 20 and 140 Å,

- a total pore volume, measured by mercury porosimetry, encompassed between 0.1 ml/g and 0.6 ml/g,
- a total pore volume, measured by nitrogen porosimetry, encompassed between 0.1 ml/g and 0.6 ml/g,
- a BET specific surface area encompassed between 150 and 500 m²/g,
- a pore volume, measured by mercury porosimetry, encompassed in the pores with a diameter of more than 140 Å, of less than 0.1 ml/g,
- a pore volume, measured by mercury porosimetry, encompassed in the pores with a diameter of more than 160 Å, of less than 0.1 ml/g,
- a pore volume, measured by mercury porosimetry, encompassed in the pores with a diameter of more than 200 Å, of less than 0.1 ml/g,
- a pore volume, measured by mercury porosimetry, encompassed in the pores with a diameter of more than 500 Å, of less than 0.01 ml/g,
- a pore distribution such that the ratio between volume V2, measured by mercury porosimetry, encompassed between $D_{\text{mean}} - 30 \text{ Å}$ and $D_{\text{mean}} + 30 \text{ Å}$ to the total mercury volume is more than 0.6 – volume V3, measured by mercury porosimetry, encompassed in the pores with a diameter of more than $D_{\text{mean}} + 30 \text{ Å}$ is less than 0.1 ml/g, - volume V6, measured by mercury porosimetry, encompassed in the pores with a diameter of more than $D_{\text{mean}} + 15 \text{ Å}$ is less than 0.2 ml/g,
- an X diffraction diagram that contains at least the main lines that are characteristic of at least one of the transition aluminas contained in the group that consists of the rho, chi, eta, gamma, kappa, theta and delta aluminas.

10. Process according to claim 8, wherein the substrate of the hydrocracking catalyst has the following characteristics:

- a content by weight of silica SiO_2 of between 10 and 60%,
- an Na content of less than 300 ppm by weight,
- a total pore volume of between 0.5 and 1.2 ml/g that is measured by mercury porosimetry,
- a specific surface area of more than $200 \text{ m}^2/\text{g}$, and
- a porosity that is defined as follows:

- iii) a volume of mesopores whose diameter is between 40 \AA and 150 \AA , and whose mean diameter varies between 80 and 120 \AA representing between 30 and 80% of the total pore volume that is defined above,
- iv) a volume of macropores, whose diameter is more than 500 \AA and, preferably, between $1,000 \text{ \AA}$ and $10,000 \text{ \AA}$, represents between 20 and 80% of the total pore volume.

11. Process according to any of claims 1 to 10, wherein the hydrocracking stage is carried out at a temperature T_2 that is encompassed between 300 and 400°C .